GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–III (NEW) EXAMINATION – SUMMER 2024

Subject Code:3132003   **Date:29-06-2024**
Subject Name: Design Concepts in Basic Electronics
Time:10:30 AM TO 01:00 PM   **Total Marks:70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Explain the significance of the binary number system in digital electronics.	**03**
	(b)	Differentiate between analog system and digital system.	**04**
	(c)	Explain Excess-3 code and gray code.	**07**
Q.2	**(a)**	Simplify the Boolean expression $F=A'B+AB'+AB$ using Boolean algebraic laws. Show each step of the simplification process.	**03**
	(b)	Describe the purpose of parity bits in error detection and correction, and illustrate with an example how parity bits are used to detect errors in data transmission.	**04**
	(c)	Describe the operation of a multiplexer (MUX) and its application in digital circuits. Provide a schematic diagram of a 4-to-1 MUX and explain how it selects one of four input data lines based on the control inputs.	**07**
		OR	
	(c)	Discuss the application of Gray code in rotary encoders. Explain how Gray code prevents errors during rotational movement sensing and provide a real-world example to support your explanation.	**07**
Q.3	**(a)**	Explain the operation of a half-adder circuit and draw its logic diagram using basic logic gates. Include the truth table for the half-adder.	**03**
	(b)	Explain role of multiplexer in digital electronics, explain with diagram.	**04**
	(c)	Draw true table and logic diagram of 3 to 8 line decoder.	**07**
		OR	
Q.3	**(a)**	What are POS forms of Boolean Expression?	**03**
	(b)	Differentiate between a latch and a flip-flop, highlighting their differences in functionality and application.	**04**
	(c)	Design a 4-bit binary adder circuit using full-adder modules. Explain the operation of the circuit and provide the truth table for the 4-bit addition.	**07**
Q.4	**(a)**	State application of counters.	**03**
	(b)	Classify the various modes of operation of shift registers.	**04**
	(c)	Draw the logic diagram of a 4-bit parallel-in-parallel-out (PIPO) register using D flip-flops. Explain how data is loaded into and read from the register	**07**
		OR	
Q.4	**(a)**	Explain the difference between conductors, semiconductors, and insulators based on their electrical conductivity. Provide examples of materials belonging to each category and discuss their applications?	**03**
	(b)	Explain the term "fan-in" in the context of logic families. Describe how fan-in affects the performance and reliability of digital circuits.	**04**
	(c)	Explain the voltage Doubler, Tripler and Quadrupler circuits in details.	**07**

Q.5 (a) Calculate the average output voltage of a half-wave rectifier circuit with a sinusoidal input voltage. Consider the ideal diode model and neglect any ripple voltage. **03**

(b) Explain the load line analysis for diode. **04**

(c) Draw the output waveform of a full-wave rectifier circuit with a sinusoidal input voltage. Label the key points such as peak voltage, average voltage, and ripple voltage. **07**

OR

Q.5 (a) Draw the circuit diagram of a common-emitter transistor amplifier with base biasing. Explain the purpose of the biasing resistors and how they set the operating point of the transistor. **03**

(b) Explain biased negative clamper circuit. **04**

(c) Compare and contrast the base and collector characteristic curves of a BJT with different values of β (current gain). Discuss how variations in β affect the shape and slope of the curves. **07**

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